AHU-9 SEQUENCE OF CONTROL

GENERAL:

THE SYSTEM SHALL CONSIST OF A HORIZONTAL, DRAW-THRU, VARIABLE AIR VOLUME AIR HANDLING UNIT WITH A HOT WATER HEATING COIL, A CHILLED WATER COOLING COIL, A FILTER-MIXING BOX AND A VARIABLE FREQUENCY DRIVE UNIT FOR SUPPLY FAN VOLUME CONTROL. THE SYSTEM SHALL HAVE THREE MODES OF OPERATION: VENTILATION DELAY, OCCUPIED AND UNOCCUPIED. THE MODE THAT THE SYSTEM IS OPERATING IN SHALL BE BASED ON THE DDC SYSTEM .

SAFETY CONTROLS:

LOW TEMPERATURE PROTECTION THERMOSTAT: THE DDC SYSTEM SHALL MONITOR THE AIR TEMPERATURE AT THE ENTERING AIR SIDE OF THE COOLING COIL THROUGH LOW TEMPERATURE THERMOSTAT TSL-09-01. THE THERMOSTAT SHALL BE PROVIDED WITH TWO SETS OF DPDT CONTACTS. SHOULD THE AIR TEMPERATURE FALL BELOW 3 DEGREES C (ADJUSTABLE) ONE SET OF CONTACTS SHALL BE OPEN, WHICH SHALL STOP THE SUPPLY FAN BY OPENING THE VFD-09 SAFETY SHUTDOWN CIRCUIT. THE SECOND SET OF CONTACTS SHALL CLOSE PROVIDING AN INPUT TO THE DDC SYSTEM WHICH SHALL GENERATE AN EMCS LOW TEMPERATURE ALARM. THE LOW TEMPERATURE ALARM SHALL INDICATE WHICH AIR HANDLING UNIT WAS INVOLVED. THE LOW TEMPERATURE THERMOSTAT SHALL NOT REQUIRE MANUAL RESET AT THE DEVICE.

SMOKE CONTROL: SMOKE DETECTORS SMK-09-01 SHALL BE LOCATED IN THE SUPPLY AND RETURN DUCTS RESPECTIVELY. UPON DETECTION OF SMOKE, BY EITHER DETECTOR, THE DDC SYSTEM SHALL STOP THE SUPPLY FAN BY OPENING CONTACT C-09-02 IN THE VFD-09 SAFETY SHUTDOWN CIRCUIT AND SHALL INITIATE AN EMCS SMOKE DETECTION ALARM. THE ALARM SHALL INDICATE WHICH DETECTOR(S) WAS (WERE) AFFECTED. RESTARTING THE SUPPLY FAN SHALL NOT REQUIRE MANUAL RESET OF THE AFFECTED SMOKE DETECTOR(S).

PRE-FILTER: DIFFERENTIAL PRESSURE SWITCH DPS-09-01, ACROSS THE PREFILTER, SHALL INITIATE AN EMCS DIRTY FILTER ALARM SHOULD THE PRESSURE DROP ACROSS THE PRE-FILTER EXCEED 185 KPa (ADJUSTABLE). THE ALARM SHALL INDICATE WHICH FILTER WAS AFFECTED.

MIXED AIR FILTER: DIFFERENTIAL PRESSURE SWITCH DPS-09-02, ACROSS THE MIXED AIR FILTER, SHALL INITIATE AN EMCS DIRTY FILTER ALARM SHOULD THE PRESSURE DROP ACROSS THE MIXED AIR FILTER EXCEED 185 KPa (ADJUSTABLE). THE ALARM SHALL INDICATE WHICH FILTER WAS AFFECTED.

SUPPLY FAN: THE OPERATION OF THE SUPPLY FAN SHALL BE MONITORED BY THE DDC SYSTEM THROUGH DIFFERENTIAL PRESSURE SWITCH DPS-09-03. WITH THE SUPPLY FAN STARTED BY THE DDC SYSTEM, SHOULD AIR FLOW ACROSS THE FAN NOT BE DETECTED THE DDC SYSTEM SHALL STOP THE SUPPLY FAN BY OPENING CONTACT C-09-02 IN THE VFD-09 SAFETY SHUTDOWN CIRCUIT AND SHALL INITIATE AN EMCS LOSS OF AIR FLOW ALARM. THE ALARM SHALL INDICATE WHICH AIR HANDLING UNIT WAS AFFECTED. A DELAY OF 30 SECONDS (ADJUSTABLE) SHALL BE PROVIDED, AFTER STARTING THE FAN, BEFORE A LOSS OF AIR FLOW ALARM CAN BE GENERATED.

HIGH SUPPLY DUCT STATIC PRESSURE: DIFFERENTIAL PRESSURE SWITCH DPS-09-04 SHALL BE LOCATED IN THE SUPPLY DUCT. SHOULD THE SUPPLY DUCT STATIC PRESSURE EXCEED 875 Pa THE DDC SYSTEM SHALL STOP THE SUPPLY FAN BY OPENING CONTACT C-09-02 IN THE VFD-09 SAFETY SHUTDOWN CIRCUIT AND SHALL INITIATE AN EMCS HIGH STATIC PRESSURE ALARM. THE ALARM SHALL INDICATE WHICH AIR HANDLING UNIT WAS AFFECTED.

SUPPLY FAN CONTROL:

WITH NO SAFETY CONTROLS GENERATING SHUTDOWN ALARMS THE DDC SYSTEM SHALL ENABLE VARIABLE FREQUENCY DRIVE UNIT VFD-09 THROUGH THE UNITS SAFETY SHUT DOWN CIRCUIT BY CLOSING CONTACT C-09-02.

VENTILATION DELAY MODE: WITH THE SYSTEM IN THE VENTILATION DELAY MODE THE DDC SYSTEM SHALL START THE SUPPLY FAN BY CLOSING CONTACTS C-09-02 LOCATED IN THE VFD-09 RUN PERMISSIVE CIRCUIT. THE VARIABLE FREQUENCY DRIVE UNIT SHALL MODULATE THE FAN SPEED IN ORDER TO MAINTAIN A SUPPLY DUCT STATIC PRESSURE OF 375 Pa (ADJUSTABLE) AS SENSED BY PRESSURE SENSOR DPT-09-01.

OCCUPIED MODE: WITH THE SYSTEM IN THE VENTILATION DELAY MODE THE DDC SYSTEM SHALL START THE SUPPLY FAN BY CLOSING CONTACTS C-09-02 LOCATED IN THE VFD-09 RUN PERMISSIVE CIRCUIT. THE VARIABLE FREQUENCY DRIVE UNIT SHALL MODULATE THE FAN SPEED IN ORDER TO MAINTAIN A SUPPLY DUCT STATIC PRESSURE OF 375 Pa (ADJUSTABLE) AS SENSED BY PRESSURE SENSOR DPT-09-01.

UNOCCUPIED MODE: WITH THE SYSTEM IN THE UNOCCUPIED MODE THE SUPPLY FAN SHALL BE OFF. SHOULD THE SPACE TEMPERATURE, AS SENSED BY TEMPERATURE SENSOR TT-09-02, FALL BELOW 13 DEGREES C (ADJUSTABLE) OR RISE ABOVE 29.4 DEGREES C (ADJUSTABLE) THE SUPPLY FAN SHALL BE STARTED BY CLOSING CONTACTS C-09-02 LOCATED IN THE VFD-09 RUN PERMISSIVE CIRCUIT. THE VARIABLE FREQUENCY DRIVE UNIT SHALL MODULATE THE SUPPLY FAN SPEED IN ORDER TO MAINTAIN A SUPPLY DUCT STATIC PRESSURE OF 375 Pa (ADJUSTABLE) AS SENSED BY PRESSURE SENSOR DPT-09-01. SHOULD THE SPACE TEMPERATURE RISE ABOVE 15.5 DEGREES C OR FALL BELOW 27 DEGREES C THE DDC SYSTEM SHALL STOP THE SUPPLY FAN BY OPENING CONTACTS C-09-02.

MIXED AIR CONTROL:

VENTILATION DELAY MODE: WITH THE SYSTEM IN THE VENTILATION DELAY MODE THE OUTSIDE AIR, RETURN AIR AND EXHAUST AIR DAMPERS, AD-09-01, AD-09-02 AND AD-09-03 RESPECTIVELY, SHALL BE IN THEIR NORMAL POSITION CAUSING THE SYSTEM TO OPERATE USING 100 PERCENT RETURN AIR.

OCCUPIED MODE: WITH THE SYSTEM IN THE OCCUPIED MODE THE AMOUNT OF OUTSIDE AIR ALLOWED INTO THE SYSTEM SHALL BE BASED ON THE OCCUPANCY IN THE SPACES SERVED BY AIR HANDLING UNIT AHU-9

EACH SENSOR SHALL PROVIDE AN INPUT TO THE DDC SYSTEM WHEN THE ROOM IN WHICH IT IS LOCATED IS OCCUPIED. THE DDC SYSTEM SHALL MODULATE THE OUTSIDE AIR AND RETURN AIR DAMPERS IN ORDER TO PROVIDE THE APPROPRIATE AMOUNT OF OUTSIDE AIR. THE AMOUNT OF OUTSIDE AIR ALLOWED INTO THE SYSTEM SHALL BE MONITORED BY FLOW MEASURING STATION AFMA-09-01 LOCATED IN THE OUTSDIE AIR DUCT.

UNOCCUPIED MODE: WITH THE SYSTEM IN THE UNOCCUPIED MODE THE OUTSIDE AIR, RETURN AIR AND EXHAUST AIR DAMPERS, AD-09-01, AD-09-02 AND AD-09-03 RESPECTIVELY, SHALL BE IN THEIR NORMAL POSITIONS.

PRE-HEAT COIL CONTROL:

VENTILATION DELAY MODE: WITH THE SYSTEM IN THE VENTILATION DELAY MODE THE PREHEAT COIL CONTROL VALVE, VLV-09-01, SHALL BE MODULATED BY THE DDC SYSTEM IN ORDER TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 10.5 DEGREES C (ADJUSTABLE) AS SENSED BY THE SUPPLY AIR TEMPERATURE SENSOR TT-09-01.

OCUUPIED MODE: WITH THE SYSTEM IN THE OCCUPIED MODE THE PREHEAT COIL CONTROL VALVE, VLV-09-01, SHALL BE MODULATED BY THE DDC SYSTEM IN ORDER TO MAINTAIN A SUPPLY AIR TEMEPRATURE OF 10.5 DEGREES C (ADJUSTABLE) AS SENSED BY THE SUPPLY AIR TEMPERATURE SENSOR TT-09-01.

UNOCCUPIED MODE: WITH THE SYSTEM IN THE UNOCCUPIED MODE AND WITH THE SUPPLY FAN FAN RUNNING DUE TO LOW SPACE TEMPERATURE THE PREHEAT COIL CONTROL VALVE, VLV-09-01, SHALL BE POSITIONED FOR FULL HEATING WATER FLOW THROUGH THE PREHEAT COIL. WITH THE SUPPLY FAN STOPPED THE PREHEAT COIL CONTROL VALVE SHALL BE POSITIONED FOR NO FLOW THROUGH THE PREHEAT COIL.

COOLING COIL CONTROL:

VENTILATION DELAY MODE: WITH THE SYSTEM IN THE VENTILATION DELAY MODE THE COOLING COIL CONTROL VALVE, VLV-09-02, SHALL BE MODULATED BY THE DDC SYSTEM IN ORDER TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 13.3 DEGREES C (ADJUSTABLE) AS SENSED BY THE SUPPLY AIR TEMPERATURE SENSOR TT-09-01.

OCCUPIED MODE: WITH THE SYSTEM IN THE OCCUPIED MODE THE COOLING COIL CONTROL VALVE, VLV-09-02, SHALL BE MODULATED BY THE DDC SYSTEM IN ORDER TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 13.3 DEGREES C (ADJUSTABLE) AS SENSED BY THE SUPPLY AIR TEMPERATURE SENSOR TT-09-02.

UNOCCUPIED MODE: WITH THE SYSTEM IN THE UNOCCUPIED MODE AND WITH THE SUPPLY FAN RUNNING DUE TO HIGH SPACE TEMPERATURE THE COOLING COIL CONTROL VALVE, VLV-09-02, SHALL BE POSITIONED FOR FULL COOLING WATER FLOW THROUGH THE COIL. WITH THE FAN STOPPED THE COOLING COIL CONTROL VALVE SHALL BE POSITIONED FOR NO FLOW THROUGH THE COOLING COIL.

VAV BOX CONTROL:

ALL MODES: EACH VAV BOX SHALL BE PROVIDED WITH A VAV BOX CONTROLLER. THE VAV BOX CONTROLLER SHALL PROVIDE VOLUME CONTROL AND HOT WATER HEATING COIL CONTROL FOR ITS ASSOCIATED VAV BOX. EACH VAV BOX CONTROLLER SHALL BE PROVIDED WITH A SPACE TEMPERATURE SENSOR (T) (SEE VAV OPERATING DIAGRAM SHT. M6.12). THE VAV BOX CONTROLLER SHALL MODULATE THE VOLUME DAMPER AND THE HEATING COIL CONTROL VALVE IN ORDER TO MAINTAIN THE SPACE TEMPERATURE AT 21.1 DEGREES C (ADJUSTABLE) FOR HEATING AND 25.6 DEGREES C (ADJUSTABLE) FOR COOLING. EACH VAV BOX SHALL PROVIDE A MINIMUM AMOUNT OF AIR IN ACCORDANCE WITH THE VAV BOX SCHEDULE, SHOWN ON THE MECHANICAL EQUIPMENT SCHEDULE SHEETS.

FOR INFORMATION ONLY

THIS DRAWING INCLUDED FOR INFORMATION ONLY

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: G.D.R.	SITE NAME: OMAHA DISTRICT DESIGN GUIDE		SITE LOCATION
Drawn by: G.D.R.	**HVAC CONTROLS EXAMPLE DRAWING**		
Checked by: R.G.G.			
Reviewed by: S.G.E.	Plot Scale Ratio: 1:1	Date: X	Sheet reference number: **M6.02**
	Design File: PE21M602.DGN		
Submitted by: Chief: MECHANICAL Section	Spec. No.: DACA 45	Drawing Code: X	
	Contract No.: DACA 45		

COMPUTER AIDED DESIGN & DRAFTING

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